



RESEARCH DEPARTMENT

REPORT

**Interference caused by television
receivers to reception at 200kHz**

D.J. Whythe, B.Sc., M.I.E.E., C.Eng., A.C.G.I.

INTERFERENCE CAUSED BY TELEVISION RECEIVERS TO RECEPTION AT 200 kHz
D.J. Whythe, B.Sc., M.I.E.E., C.Eng., A.C.G.I.

Summary

A survey is described of the degree and widespread nature of the interference caused by television receivers to Radio 4 reception on 200 kHz. Seventy-five fully-completed questionnaires were received from BBC engineering staff and members of BREMA, from locations spread widely over the UK.*

The survey showed that 58 of those 75 questionnaires reported an impairment to 200 kHz reception which, on average, exceeded one grade on the CCIR 5-point impairment scale, when the 200 kHz receiver was within 3 m from the television receiver but that the effect reduced rapidly with distance, the average impairment becoming only about ½ grade when the receivers were 5 m apart. On the other hand, partition walls of brick or stone-built houses provided negligible protection.

Monochrome and colour television receivers caused similar degrees of interference; no individual make or model appeared to be either particularly good or particularly bad.

* British Radio Equipment Manufacturers Association.

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INTERFERENCE CAUSED BY TELEVISION RECEIVERS TO RECEPTION AT 200 kHz

Section	Title	Page
	Summary	Title Page
1.	Introduction	1
2.	Conditions of survey	1
3.	Results	1
4.	The probable effect of changing the carrier frequency to 198 kHz	2
5.	Conclusions	3
6.	Acknowledgements	3
7.	Appendix	5

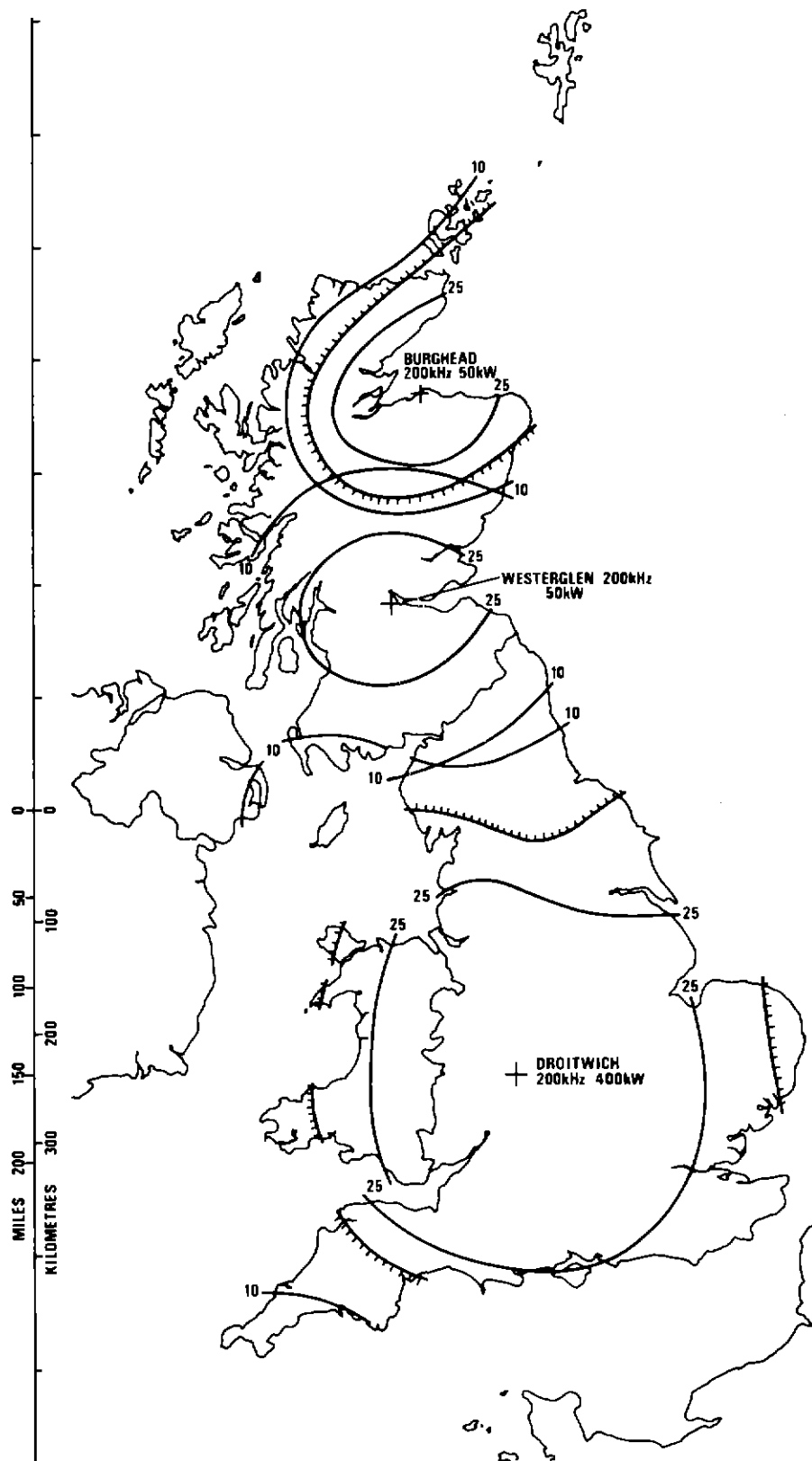


Fig. 1 - Coverage at 200 kHz

— Field strength, mV/m - - - Night-time fading limits

INTERFERENCE CAUSED BY TELEVISION RECEIVERS TO RECEPTION AT 200 kHz

D.J. Whyte, B.Sc., M.I.E.E., C.Eng., A.C.G.I.

1. Introduction

One consequence of the l.f./m.f. Regional Administrative Broadcasting Conference (Geneva, 1975) was a BBC decision to broadcast the Radio 4 (UK) programme on l.f. (200 kHz) in place of Radio 2. This decision was implemented when the Geneva plan was brought into operation in November 1978 and, since then, the BBC Engineering Information Department has received complaints of interference to reception on 200 kHz. It was considered that one possible source of the interference might arise from the power radiated from television receivers at harmonics of line and field frequencies in the long-wave band. This Report describes a survey that was carried out, following consultations with BREMA,* in order to assess the severity and widespread nature of such interference.

2. Conditions of survey

The questionnaire shown in the Appendix was prepared by BBC Research Department in consultation with BBC Engineering Information Department. Copies were sent out during October 1979 to be completed by engineers at locations spread widely over the UK.

3. Results

In all, 85 reports were received by March 1980. Of those, 9 referred to monochrome and 76 to colour television receivers.

Fig. 1 shows the field strength contours and night-time fading limits of the transmitters operating on 200 kHz at the time. Only two of the reports (both for colour receivers) were from locations beyond the fading limits of all the transmitters. As would be expected from the geographic distribution of population densities, the great majority of reports (69) were received from locations spaced between 100 km and 200 km from Droitwich. Four reports were from locations within 100 km, nine from between 200 km and 300 km and three from beyond 300 km. Since the field-strength at these ranges can be regarded as varying substantially inversely with range, the nominal field-strength was approximately the same

(i.e. within ± 3 dB) at most of the locations reported upon (i.e. 69 out of 85). Bearing in mind that the field-strength generally varies by considerably more than ± 3 dB from place to place within a building, depending upon the proximity of nearby steelwork, water pipes, etc., the following analysis will regard the field-strength as being the same at each of the 85 locations from which reports were received and will assess the results only in terms of the change of subjective impairment grading (see Appendix) of reception at 200 kHz caused by interference from the television receiver. Assessed in that way, the results are given in Table 1.

As Table 1 shows, a few reports stated that reception at 200 kHz was actually improved when the television receiver was switched on. Such reports are not necessarily invalid because, as stated above, the field-strength in a building varies widely as a function of proximity to steelwork and it could be that, for those few reports, the 200 kHz receiver may have been placed in some region of low field-strength, or near to some other local source of interference, when the assessment of reception was made with the television receiver switched off.

The reports showed no consistent variation of impairment when the 200 kHz receiver was kept at 3 m from the television receiver and moved to either side of the central position (see Appendix). The value quoted in Table 1 for 3 m spacing is therefore the average of all the central-position assessments.

There did not appear to be any consistently-preferred orientation for the 200 kHz receiver, neither relative to the direction of the television receiver nor to the bearing of the Droitwich 200 kHz transmitter.

There also did not appear to be any particular television receiver that was consistently found to cause any given degree of interference to 200 kHz reception. Of the 17 television receivers (four monochrome, thirteen colour) that caused no perceptible impairment, all were different makes and models except for four colour receivers which were all similar. However, a fifth receiver of this same kind was found to impair reception at 200 kHz by two grades.

* British Radio Equipment Manufacturers Association.

TABLE 1

Change in subjective grading of reception at 200 kHz caused by television receivers*

	At 3 m from television receiver		At 5 m from television receiver		Through wall at 3 m from television receiver	
	Colour	Mono	Colour	Mono	Colour	Mono
Number of valid reports	66	9	53	5	54	6
Mean worsening of subjective grade	1.30	1.22	0.41	0.75	1.13	1.20
Number of reports of improved subjective grade	2	0	6	1	1	1

* CCIR 5-point Impairment Scale, see Questionnaire in Appendix.

Twenty-five of the 85 reports received also included an assessment when using non-portable l.f. receivers. Fourteen of these reports quoted nil impairment; the average of the impairments quoted in the remaining eleven was 1.86 grades. For 50% of the reports quoting nil impairment, the 200 kHz receiver and the television receiver were both in the same room.

In the section inviting general comments on l.f. and m.f. reception (at the foot of page 2 of the questionnaire), the comments were so diverse that it is not feasible to summarise them here.

4. The probable effect of changing the carrier frequency to 198 kHz

It was agreed at the 1979 World Administrative Radio Conference that all the carrier frequencies adopted in the l.f. band should be changed to become integral multiples of 9 kHz and, as part of its implementation, it was agreed that the carrier-frequency of Channel 6 should be changed from 200 kHz to 198 kHz as from 1st February 1988.*

Fig. 2 shows the spectral distribution of interfering signals in the l.f. band caused by a typical television receiver. It is evident the interference dominates at harmonics of the line frequency

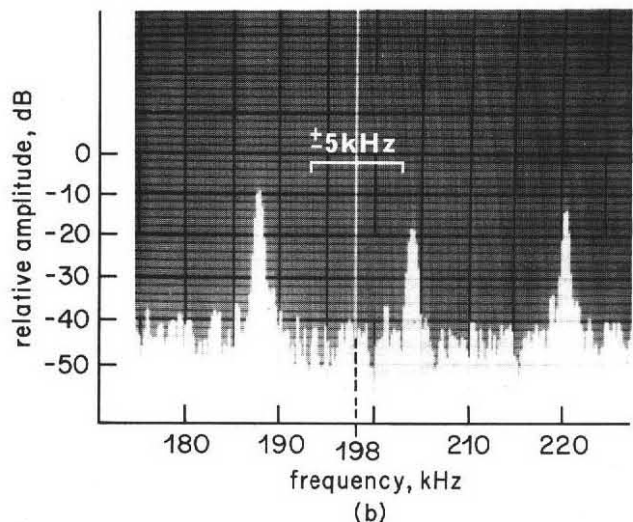
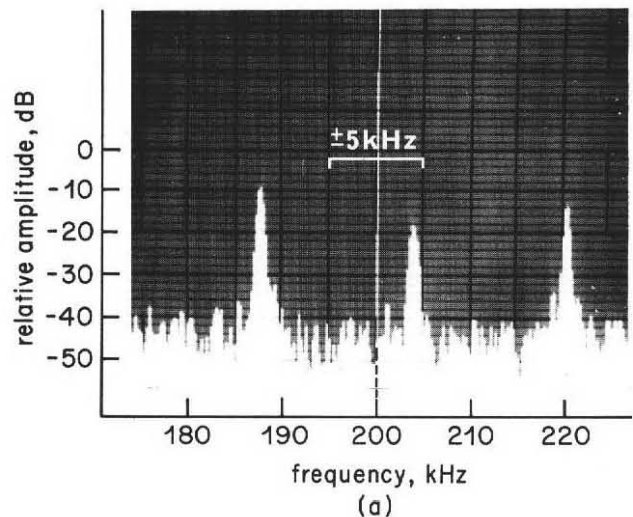


Fig. 2 - Spectral distribution of interfering signals (Test card F picture)

* It is hoped that it may be permissible to effect this change as from 1st February 1986 but to do so would involve further international agreement which has not so far been reached.

(15.625 kHz) but that it also occurs at lower level at virtually all the intermediate frequencies. Thus the interference is more severe at 203.125 kHz and 187.5 kHz (12th and 13th harmonics) than at about 195 kHz.

When the l.f. carrier frequency is changed from 200 kHz to 198 kHz, therefore, the interference to reception caused by television receivers is expected to be reduced, but probably not by very much.

5. Conclusions

This Report has shown that the great majority of television receivers (i.e. 58 of the 75 reported upon) cause interference to reception at 200 kHz.

The level of the interference reduces rapidly, however, as a function of distance from the television receiver. As shown in Table 1, for example, the average television receiver impairs 200 kHz reception by rather more than one grade at 3 m range but by only about $\frac{1}{2}$ grade at 5 m range. On the other hand, partition walls in typical brick or stone-built houses provide negligible protection

against the interference. Thus a television receiver near to a wall in one room may cause significant interference to a 200 kHz receiver situated near to the other side of the wall (such as a 200 kHz receiver belonging to the next-door neighbour).

Monochrome and colour television receivers both caused a similar degree of interference and, so far as it can be judged from the results obtained, no individual make or model appeared to be either particularly good or particularly bad in that respect.

When, in the near future, the l.f. carrier frequency is changed from 200 kHz to 198 kHz, the interference to reception caused by television receivers is expected to be reduced, though not by very much.

6. Acknowledgements

The assistance of the many engineers who participated, and the work of the BBC Engineering Information Department in sending out many of the questionnaires, are gratefully acknowledged.

7. Appendix

BBC RESEARCH DEPARTMENT

INTERFERENCE TO RECEPTION AT 200 KHZ CAUSED BY TELEVISION RECEIVERS

Introductory Notes

Complaints have been received that some television receivers cause interference to reception of Radio 4 on 200 kHz (1500 m). So that we can assess how widespread the trouble is, we would be grateful if you would please assess the severity of the interference using your own television and l.f. battery-portable and/or fixed receivers, filling in the attached questionnaire.

Figure 1 of the questionnaire shows a notional plan of the room in which your television receiver may be fitted. The precise shape of the room, however, is unimportant for these tests. Would you please mark on it the position of your television receiver and also what is the general Northerly direction.

Would you please tune your battery portable to Radio 4 on 200 kHz (1500 m) and, holding it directly in front of the television tube, and spaced approximately 3 metres from it, rotate the battery portable about its vertical axis so as to minimise the interference to Radio 4 reception caused by the television receiver. Please show on Fig. 1 the orientation of the receiver (i.e. draw a line indicating the direction of its longest dimension) and also the subjective grade of the resulting interference to Radio 4 reception, judged according to the CCIR 5-point impairment scale:

GRADE	IMPAIRMENT
5	Imperceptible
4	Perceptible but not annoying
3	Slightly annoying
2	Annoying
1	Very annoying

Fig. 2 (overleaf) shows, by way of example, how your findings might be marked on Fig. 1 of the questionnaire.

Would you please repeat the measurement at two or three other points in the room, also at about 3 metres from the television receiver and, if the room is large enough, one further similar measurement directly in front of the television receiver at about 5 metres from it, marking on Fig. 1 the positions at which these measurements were made and, as before, the orientation of the receiver and the subjective grade of the resulting interference at each of the positions.

Finally, would you please take the battery portable into an adjacent room (or out of doors) so that it is again spaced about 3 metres from the television receiver but separated from it by a partition wall. Holding the receiver at about the same height above ground as before, and with it rotated as before

Continued/ . . .

for the least interference, please mark its position and orientation on Fig. 1 together with the grade of the resulting interference to Radio 4 reception. Please also specify the type of partition wall separating one receiver from the other.

If you have a non-portable l.f. receiver (e.g. a v.h.f. tuner with an l.f. band) we would be grateful if you would also please complete that part of the questionnaire.

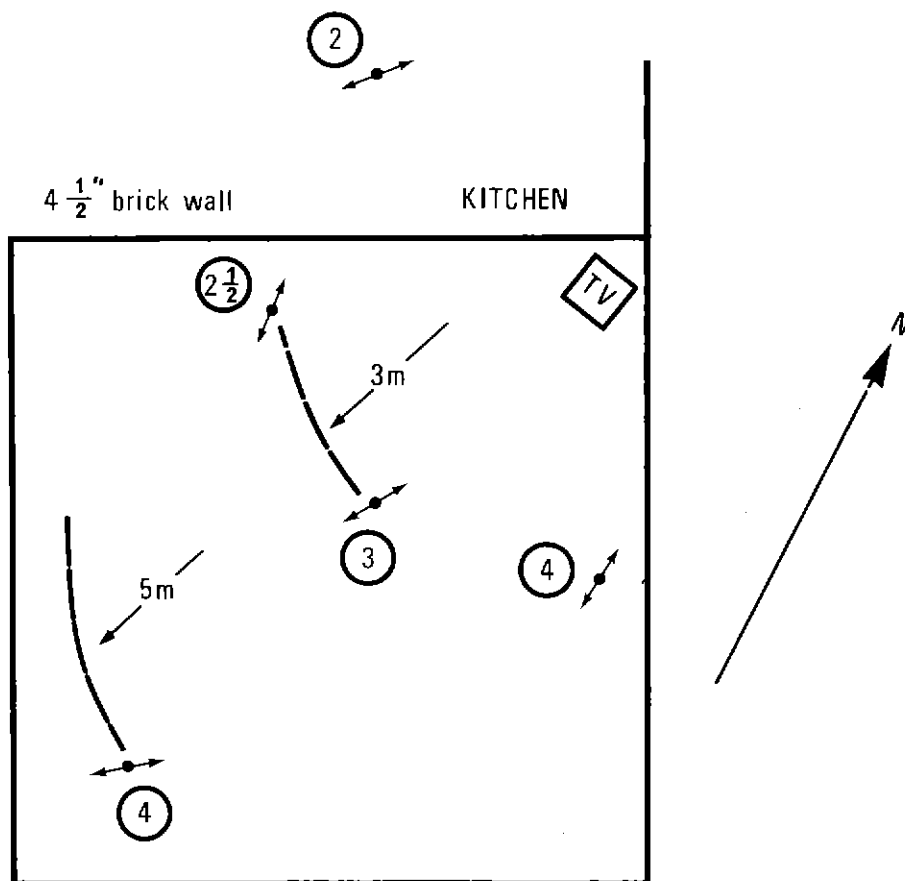


Fig. 2 - Possible example of Fig. 1 when completed

If you have more than one television receiver you may care to complete more than one questionnaire. Additional copies would gladly be supplied from the address given on page 2 of the questionnaire.

QUESTIONNAIRE

Interference to reception at 200 kHz (1500 m) caused by television receivers

Name Address

Date

• • • • •

Type of building and construction

Detached house ☐

Brick or stone ☐

Semi-detached house ☐

Weatherboarding ☐

Terraced house ☐

Reinforced concrete ☐Bungalow ☐Steel framed ☐Flat or Maisonette ☐

Other (please specify)

Other (please specify)

.....

Television receiver

Make Model No.

Monochrome? ☐

Colour? ☐

Portable l.f. receiver

Make **Model No.**

Grade of impairment to R4 reception when TV receiver switched off ☐

Non-portable l.f. receiver

Make **Model No.**

Type of l.f. aerial (e.g. internal ferrite or external wire aerial)

If directional, is it oriented for best R4 reception?

Is a v.h.f. aerial and feeder attached?

Grade of impairment to R4 reception when TV receiver: switched off ☐

switched on ☐

Location relative to TV receiver

Continued/.

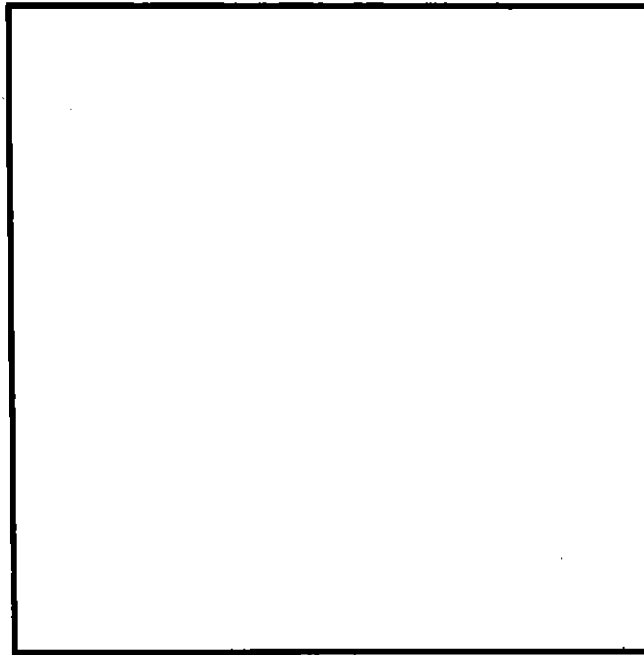


Fig. 1: Measuring points relative to TV receiver

Do you have any problems (a) with R4 reception at 200 kHz? or (b) with reception of BBC programmes on m.f.?

.....
.....

Any further comments

When complete, please return this questionnaire to:

D.J. Whythe,
BBC Research Department,
Kingswood Warren,
Tadworth,
Surrey.
KT20 6NP